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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/888,989	06/25/2001	Hubert Jerominek	9680.173USU1	9540

23552 7590 02/12/2004

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EXAMINER	
RUGGLES, JOHN S	

ART UNIT	PAPER NUMBER
1756	

DATE MAILED: 02/12/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/888,989	HUBERT JEROMINEK	
	Examiner	Art Unit	
	John Ruggles	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 October 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-36* is/are pending in the application.

4a) Of the above claim(s) *19-36* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,5,6,8-10,12 and 13* is/are rejected.

7)☒ Claim(s) *4,7,11 and 14-18* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Claims 19-36 remain withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention. Therefore, only claims 1-18 remain under consideration.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3, 5-6, 8-10, and 12-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jerominek, et al. (US Patent 5,831,266) in view of Goossen, et al. (US Patent 5,443,685), further in view of Laub, et al. (US Patent 5,744,284), further in view of Tuma, et al. (US Patent 5,841,143), and further in view of Dhuler, et al. (US Patent 5,955,817).

Jerominek teaches a method of fabricating a multi-layer microbridge suspended microstructure at column 1, lines 54-55, 60 and at column 6, lines 42-43. The method includes providing a substrate layer (1st layer) with electrical contacts and covering with a temporary layer (2nd layer) of polyimide, glass, SiO2, or Si (instant claims 12-13, for polymer (polyimide) or glass) as shown at column 7, lines 51-60. This is followed by patterning and etching perpendicular or sloped cavities in the temporary layer by a combination of a standard photolithographic process to form a sloped photoresist pattern and a reactive ion etching (RIE)

process (reads on subsequent etching through the sloped photoresist pattern to obtain a surface with at least one continuous slope with a predetermined angle with respect to the 1st substrate layer) as taught in column 7, line 61 to column 8, line 5 and shown in Figure 2B (instant claim 1, steps (a)-(c), instant claim 10, for RIE of temporary layer, step (c)). Figure 2B reads on a plateau with two opposite continuous slopes, each having predetermined and substantially equal angles (reads on instant claims 2 and 3). Then, further coating (plasma enhanced chemical vapor deposition, PECVD (instant claim 5), and physical vapor deposition, PVD) and patterning by standard photolithography and dry etching (encompasses ion beam etching, as admitted by instant disclosure page 11, lines 3-4 and RIE is a specie of ion beam etching) or wet etching (instant claim 10, for dry (RIE) or wet etching of step (e)) of dielectric, metal, and electrically conductive layers (any one of which are comparative to the instant 4th layer, instant claim 1, steps (d)-(e)) is described at column 8, lines 6-44. The dielectric layer is shown to be material selected from the group consisting of Si_3N_4 and SiO_2 (instant claim 8, for Si_3N_4 and SiO_2) at column 7, lines 1-3. In column 8, lines 44-46, the electrically conductive layer is shown to form the legs of the micro support (microstructure). It is also suggested that the order of coating steps could be reversed to form the electrically conductive layer before the dielectric and metal layers at column 8, lines 46-48. Sputtering (instant claim 9, for sputtering) to deposit a radiation active layer of VO_2, V_2O_3, or Si (instant claim 8, for Si) followed by standard photolithographic patterning and etching (RIE) are shown at column 8, lines 49-65. Then, a second electrically conductive layer is deposited by PVD, followed by more dry or wet patterning, disclosed from column 8, line 66 to column 9, line 9. It is further suggested that the order of coating steps could be reversed to form the second electrically conductive layer before the radiation active layer at

column 9, lines 9-11. Column 7, lines 34-35 teach that both electrically conductive layers are made of material selected from the group consisting of Au, Ti, W, Al, V (instant claim 8, for Ti, Al, V, and Au). Finally, the remaining temporary layer is removed by isotropic wet (instant claim 6) or dry etching to reveal the suspended microstructure at column 9, lines 27-36 (instant claim 1, step (f)).

While using standard photolithography to create a sloped pattern, Jerominek does not specify using grey scale mask exposure of a photoresist layer to form the sloped pattern (instant claim 1, step (b)). Jerominek does not point out that the suspended microstructure obtained includes a plateau having opposite continuous slopes, each having substantially equal predetermined angles (instant claims 2-3). Jerominek also does not specifically point out resistive evaporation or electroplating techniques to deposit the 4th layer (instant claim 9, step (d)).

Goossen teaches a process and composition for coating a polar semiconductor onto a non-polar substrate for a variety of integrated electronic and optical applications (column 1, lines 11-15). The process involves photolithographic patterning through a gray scale mask of a resist layer (e.g., polyimide, etc., column 2, line 65) and subsequent developing, resulting in a smooth tapered resist layer 10 as shown in Figure 3 (column 3, lines 4-30 and 45-46). The tapered erodible layer of resist 10 and underlying substrate are then etched (e.g., RIE, plasma ion etching, ion milling, wet chemical etching, etc.) to transfer the smooth tapered resist profile into the substrate (column 4, lines 18-37). The gray scale mask and the relative etching rates of the resist and the substrate predetermine the required angle of taper of the resist and etched substrate (for epitaxial growth of gallium arsenide (GaAs) on silicon (Si) or germanium (Ge), a 3° taper is

preferred, column 4, lines 39-62). Tapered substrate surfaces such as these with predetermined angles are useful for a variety of applications, which include those involving subsequent coating (e.g., chemical vapor deposition, etc.) on the tapered substrate (column 5, lines 26-39). One application of this method could be fabrication of a suspended microstructure having a plateau with two opposite continuous sloped tapered supports, each made at a predetermined angle from the substrate, and the angles being either different or substantially equal.

Laub teaches a process of making microbridge (microbeam) structures (microstructures) by forming sloping photoresist patterns (temporary layers) on a substrate, coating over the sloped temporary layers with metal layers, etching the sloped metal layers into desired configurations, and removal of the temporary layers to form openings between the microbridge and the substrate. Figures 4a-j show progressive stages of this process described at column 5, line 15 to column 6, line 65. Laub specifically points out the advantage of this photolithography technique to create strong and flexible microbridges (microbeams or microstructures) with precise control over their size, shape, and position (encompasses making a plateau having opposite sloped portions positioned at substantially equal predetermined angles) at column 6, lines 52-65.

Tuma teaches fabrication of a sinusoidal, corrugated profile (sloped) multilayer article by selective photoresist exposure, developing, and transfer into underlying dielectric or sensing layer by ion beam milling or dry chemical etching (RIE). The resulting sloped profile is then coated by dielectric (including silicon nitride, Si_3N_4) and metal layers, each deposited by resistive evaporation, electron beam evaporation, ion beam, or RF sputtering shown at column 6, lines 25-64 (instant claim 9, step (d), for resistive evaporation). Tuma states that this method

provides thin films suitable (having good coating adhesion) for use in manufacturing small devices (sensors, microstructures).

Dhuler teaches fabrication of an arched beam (suspended microstructure) for a microelectromechanical system (MEMS) actuator by photoresist patterning and subsequent etching of an underlying sacrificial (temporary) plating base, followed by electroplating metal (e.g., Ni, Cu, Au, etc.) on the temporary plating base and removal of remaining photoresist along with temporary portions of the plating base layer to release the arched beam (suspended microstructure) described at column 10, lines 23-54 (instant claim 9, step (d), for electroplating). Dhuler also points out that electroplating is advantageously used for coating the arched beam (MEMS structure) in a confined space (as found in a multilayer microstructure) at column 6, lines 3-8.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the process steps of Jerominek to obtain a sloped profile with the grey scale mask photolithography shown by Goossen to obtain one or more smooth sloped profiles, each at a predetermined angle and in a single exposure step from a grey scale mask having such a design. It would also have been obvious to combine the process steps of Jerominek and Goossen with the profile and benefits shown by Laub because they relate to the art of manufacturing microstructures.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to carry out the subsequent 4th layer coating by resistive evaporation as taught by Tuma, because this method provides good coating adhesion of thin films suitable for use in manufacturing small devices (sensors, microstructures) (instant claim 9, step (d)).

It would also have been obvious to one of ordinary skill in the art at the time the invention was made to carry out the subsequent 4th layer coating by electroplating as shown by Dhuler, because this method also provides good coating adhesion in confined spaces encountered in small device (MEMS arched beam, suspended microstructure) manufacturing (instant claim 9, step (d)).

Allowable Subject Matter

Claims 4, 7, 11, and 14-18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: the additional limitations of (1) depositing a 5th planarization layer to leave the top portion of the sloped support uncovered, (2) then depositing and etching a 6th layer to form a microplatform followed by (3) subsequent removal of the 2nd temporary and 5th planarization layers to form a suspended microplatform are now considered to be allowable over the prior art of record. This is because Burns does not specifically teach using separate temporary and planarization layers on either side of a sloped support before deposition and etching of a microplatform on the sloped support, then subsequent removal of the temporary and planarization layers to form a suspended microplatform, as shown in instant Figures 10E-10G.

Response to Arguments

Applicant's arguments filed 27 October 2003 have been fully considered, and are partially persuasive.

In response to applicant's argument (beginning on page 2) that the references fail to show certain features of applicant's invention, it is again noted that the features upon which applicant relies (i.e., sloped supports which are not part of diagonally opposite inverted pyramids as shown in instant Figures 3 and 6 when compared to Figures 1 and 2B of Jerominek, 5,831,266) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, applicant is again reminded that limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Moreover, while applicant contends that the standard photolithographic process for patterning sloped supports at the time of Jerominek in 5,831,266 (filed in September of 1996) was limited to a binary method on page 2 of applicant's remarks, Goossen in 5,443,685 (issued in August of 1995) clearly shows that patterning of a smooth tapered resist layer was already known to be achieved by imaging of the resist through a gray scale mask. This is taken to mean that when needing better dimensional control to achieve a smooth tapered resist layer, gray scale mask photolithography was a known standard method for this type of resist patterning. In this regard, the instant claimed use of gray scale mask photolithographic patterning of a smoothly sloped resist profile is not distinguished over this prior art, as conceded by applicant on page 3. Even so, applicant contends that forming a suspended microstructure having supports sloped at predetermined angle(s) using gray scale mask photolithographic patterning is novel and not obvious. However, this argument is not persuasive in view of the fact that Goossen specifically states the utility of gray scale mask

photolithography and subsequent etching to achieve a specific predetermined angle of taper (e.g., 3°, etc.) in the same art of making microstructures, even if the specific topography of the microstructure is different. One of ordinary skill in the art would still have been motivated to use gray scale photolithographic patterning of an overlying resist and subsequent etching of an underlying layer in order to achieve a smooth tapered profile having a predetermined angle in the underlying layer, as taught by Goossen, in a suspended microstructure as taught by Jerominek.

Further, in response to applicant's argument that it would not have been obvious to have incorporated the Goossen gray scale mask photolithography to produce smooth tapered profiles in the Jerominek suspended microstructure, the test for obviousness is not whether the features of a secondary reference (Goossen) may be bodily incorporated into the structure of the primary reference (Jerominek); nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Laub was not intended to be bodily incorporated into the combination of Jerominek and Goossen, but rather to show the desirability of photolithography techniques to create strong and flexible microbridges or microstructures with precise control over their size, shape, and position. Also, Laub's Figure 4j specifically shows a microstructure made by such a process, having a

plateau supported by opposite sloped portions positioned at substantially equal predetermined angles. In fact, Laub's Figure 4j looks very much like applicant's instant Figure 9E, showing that this profile was known for a microstructure at the time of the instant invention.

Tuma teaches that resistive evaporation provides good coating adhesion of thin films suitable for use in manufacturing small devices such as microstructures. So, resistive evaporation would be expected to yield good results for carrying out the instant subsequent 4th layer coating. Dhuler shows that electroplating also provides good coating adhesion in confined spaces, which are encountered in small device manufacturing (for making MEMS arched beams or suspended microstructures). So, electroplating would be an obvious alternative method for carrying out the subsequent 4th layer coating.

Therefore, the criteria actually recited in claims 1-3, 5-6, 8-10, and 12-13 is still believed to be obvious over the structure made by the process of Jerominek, Goossen, Laub, Tuma, and Dhuler, for the same reasons previously set forth. Accordingly, the rejection of these claims has now been made FINAL.

On page 6, applicant argues that the Burns' second temporary layer having a nearly planar surface for the microbeam is not comparable to the instant planarization layer. However, this argument is not persuasive, because the Burns' second temporary layer is understood to have a function similar to that of a planarization layer for formation of the microbeam.

Nevertheless, applicant's additional arguments on page 6 that the process steps of Burns differ from those of instant claims 4, 7, 11, and 14-18 are found persuasive. Therefore, the previous rejection of these claims has now been withdrawn. As indicated above, instant claims

4, 7, 11, and 14-18 would be allowable over the prior art of record if rewritten in independent form, incorporating all of the limitations of rejected base claim 1.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Ruggles whose telephone number is 571-272-1390. The examiner can normally be reached on Monday-Thursday and alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

John Ruggles
Examiner
Art Unit 1756

SUPERV... TECH...